Improved Transition-edge Sensors Project

Completed Technology Project (2016 - 2017)

Project Introduction

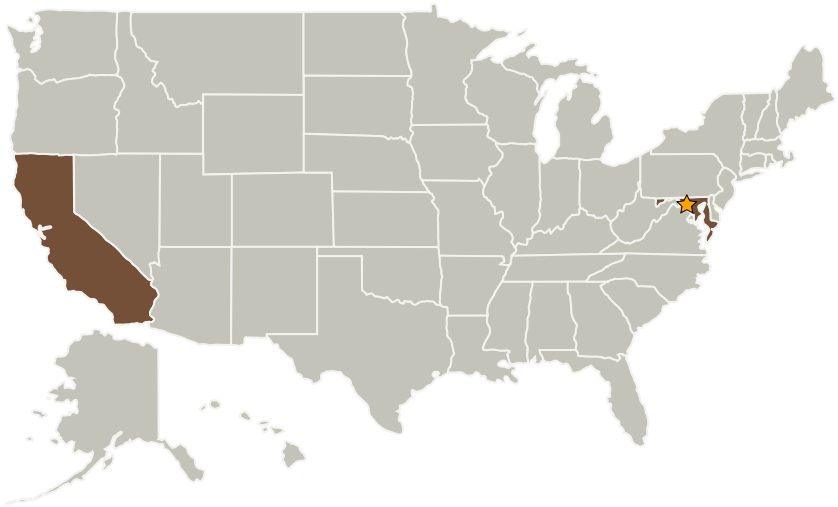
We add improved feature resolution and Josephson Junctions to recent advances in YBCO films on Si substrates to produce infrared detectors of unsurpassed performance in the far-IR with moderate cooling needs.

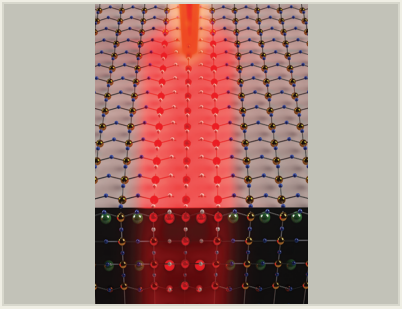
We will develop more sensitive, long-wavelength, moderately-cooled IR detectors. We extend recent advances in high quality YBCO films on Si substrates by incorporating finer feature resolution, and better Josephson Junctions. These improved IR detectors target wavelengths beyond HgCdTe, and are critical for radiometers and Fourier transform spectrometers for future space missions.
The wavelength range depends on the absorber, which is not a target of this investigation. We could use so-called space-matched coatings, which give a nearly wavelength-independent absorption of 50% when certain conditions are satisfied. Or we could use gold-black for the absorber, which gives the Cassini CIRS spectrometer coverage out to nearly 1000. microns.

Anticipated Benefits

The benefit would be improved sensitivity infrared detector arrays for science instruments.

Primary U.S. Work Locations and Key Partners





A focused helium ion beam creates a Josehpson junction in the YBCO film.

Table of Contents

Center Independent Research & Development: GSFC IRAD

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Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations	
California	Maryland

Project Transitions

October 2016: Project Start

September 2017: Closed out

Closeout Summary: The purpose of the Goddard Space Flight Center's Internal Research and Development (IRAD) program is to support new technology development and to address scientific challenges. Each year, Principal Investigators (PIs) submit IRAD proposals and compete for funding for their development projects. Goddard's IRAD program supports eight Lines of Business: Astrophysics; Communications and Navigation; Cross-Cutting Technology and Capabilities; Earth Science; Heliophysics; Planetary Science; Science Small Satellites Technology; and Suborbital Platforms and Range Services.Task progress is evaluated twice a year at the Mid-term IRAD review and the end of the year. When the funding period has ended, the PIs compete again for IRAD funding or seek new sources of development and research funding or agree to external partnerships and collaborations. In some cases, when the development work has reached the appropriate Technology Readiness Level (TRL) level, the product is integrated into an actual NASA mission or used to support other government agencies. The technology may also be licensed out to the industry.The completion of a project does not necessarily indicate that the development work has stopped. The work could potentially continue in the future as a follow-on IRAD; or used in collaboration or partnership with Academia, Industry and other Government Agencies.If you are interested in partnering with NASA, see the TechPort Partnerships documentation available on the TechPort Help tab. http://techport.nasa.gov/help

Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Center Independent Research & Development: GSFC IRAD

Project Management

Program Manager:

Peter M Hughes

Project Managers:

Brook Lakew
Michael J Amato

Principal Investigator:

John C Brasunas

Co-Investigators:

Shahid Aslam
Shane Cybart
Thomas R Stevenson

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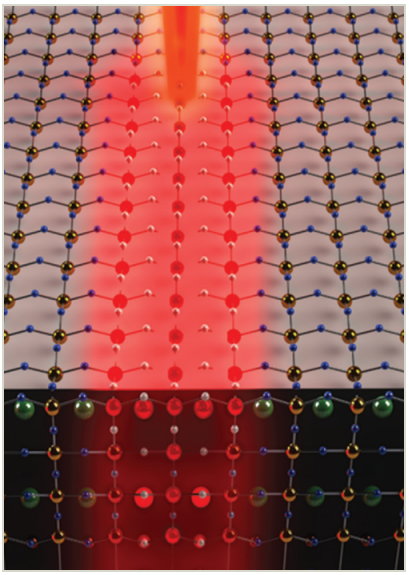
Images



Patterning the YBCO
A focused helium ion beam creates a Josehpson junction in the YBCO film.
(https://techport.nasa.gov/image/26023)

Stories

Nano Josephson superconducting tunnel junctions in YBa2Cu3O7−δ directly patterned with a focused helium ion beam
(https://techport.nasa.gov/file/34324)

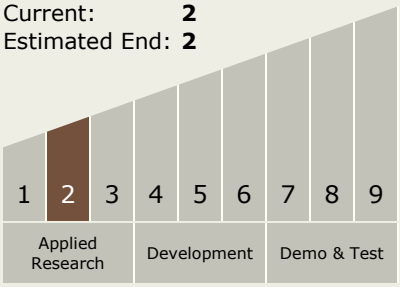
Superconducting Nano Wire Circuits Fabricated using a Focused Helium Beam
(https://techport.nasa.gov/file/34322)

Project Website:

http://sciences.gsfc.nasa.gov/sed/

Technology Maturity (TRL)

Start: **2**
Current: **2**
Estimated End: **2**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.1 Detectors and Focal Planes

Target Destinations

Earth, Mars, Others Inside the Solar System